

Multifunctional Thermo-Structural Elements for Small Spacecraft via Additive Manufacturing (MFTS)

Completed Technology Project (2016 - 2018)



Project Introduction

Development of multi-density contiguous structural panel elements, referred to as Multi-functional Thermal-Structures, with integral thermal management features via additive manufacturing approaches.

This 3rd fiscal year internally funded development effort enters into development of an approximately 70 cm by 70 cm (full scale) additively manufactured multi-functional thermal structural planar structure as well as design support for a 22 cm diameter structural shell for planetary atmospheric probes. Subscale panel development (20x23cm) will be completed early in FY 18. Direct Metal Laser Sintering (DMLS) of an Al Si Mg alloy has emerged as the leading approach for work in FY 18. Full scale panel two phase thermal characteristics and mechanical properties evaluation will be completed.

Anticipated Benefits

Multi-functional Thermal-Structures (MFTS), that are produced 40% faster than with State of the Art (SOA) fabrication techniques for 40% lower costs, 20% mass savings, 50% better thermal efficiency, with a high degree of thermal stabilization.

More efficient heat rejection than heat pipe technology commonly used in Geo com satellites.

Applicable to non NASA space missions requiring high heat rejection and high levels of thermal stabilization.

Primary U.S. Work Locations and Key Partners

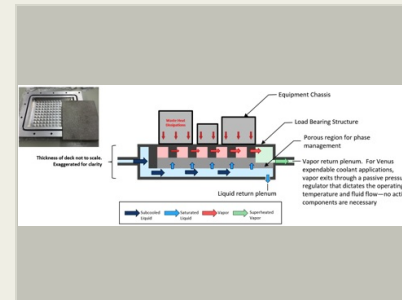
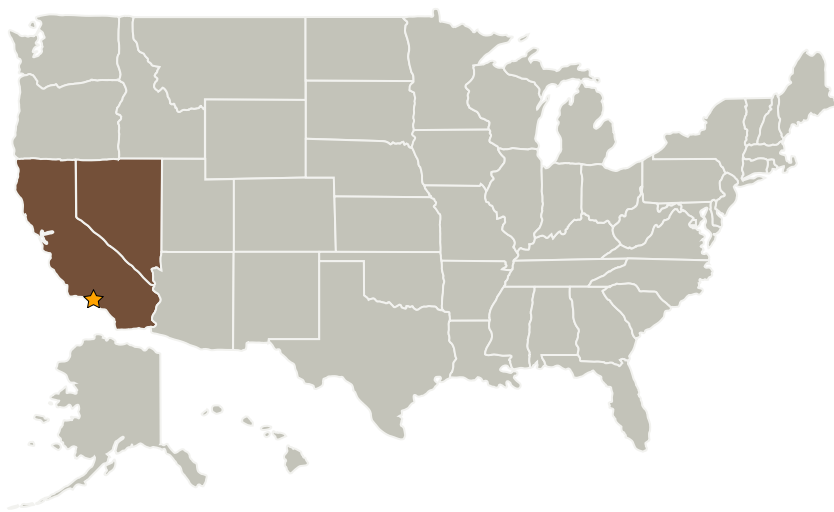


Image of traditionally manufactured unit, including pressed and sintered wick structure and machined out vapor chamber alongside a thermal path schematic.

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3
Supported Mission Type	3

Multifunctional Thermo-Structural Elements for Small Spacecraft via Additive Manufacturing (MFTS)

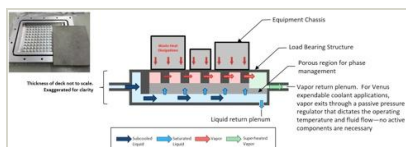
Completed Technology Project (2016 - 2018)



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Nevada

Images



JPL_IRAD_Activities Project Image

Image of traditionally manufactured unit, including pressed and sintered wick structure and machined out vapor chamber alongside a thermal path schematic.

(<https://techport.nasa.gov/image/27937>)

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:

Fred Y Hadaegh

Project Manager:

Fred Y Hadaegh

Principal Investigator:

Timothy O'donnell

Co-Investigators:

Stefano Cappucci
Benjamin I Furst
Bruno M Quadrelli
Scott N Roberts
Eric T Sunada
Ryan T Watkins

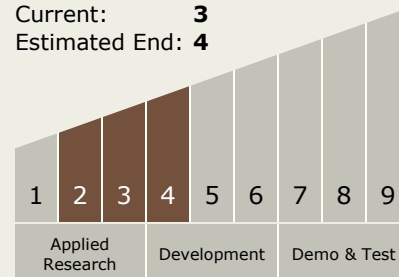
Multifunctional Thermo-Structural Elements for Small Spacecraft via Additive Manufacturing (MFTS)

Completed Technology Project (2016 - 2018)



Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.2 Structures
 - └ TX12.2.5 Innovative, Multifunctional Concepts

Target Destinations

The Moon, Mars, Others Inside the Solar System

Supported Mission

Type

Push